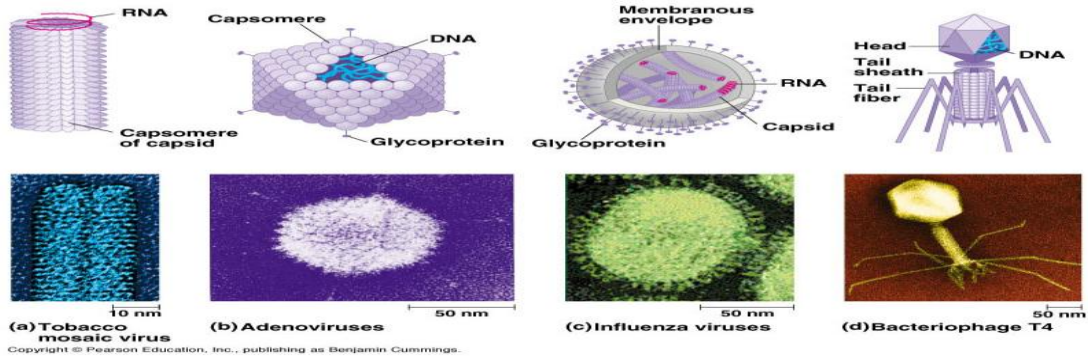


Viruses and Bacteria Notes

A. Virus Structure:

•Viruses are _____ in contrast to bacteria. Viruses are _____ (DNA or RNA) enclosed in a _____ coat called a _____. Also some viruses have a _____ that helps them infect their host. These viral envelopes are usually derived from the _____ cell to help the virus be unnoticed by the immune system and are made up of _____ and _____. Some viruses also carry a few _____ in their capsids. Viruses come in many shapes and may be _____ shaped or more complex in structure. Recall the most complex viruses called _____ infect bacteria.

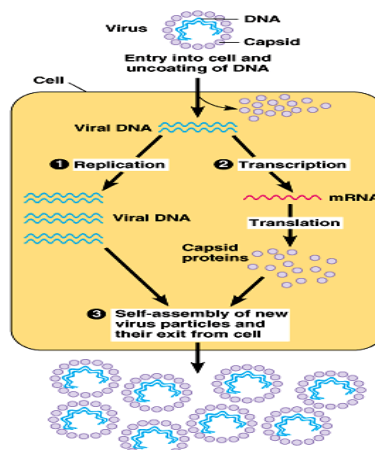


B. Virus Overview:

- Viruses can **ONLY** reproduce within a _____ cell. So when a person with a cold sneezes, the viruses released are not “activated” until a host, namely another person, gets the virus into their own body. This is because viruses lack _____ for metabolism and cannot make their own _____. Which is why many scientists classify viruses as _____ things.

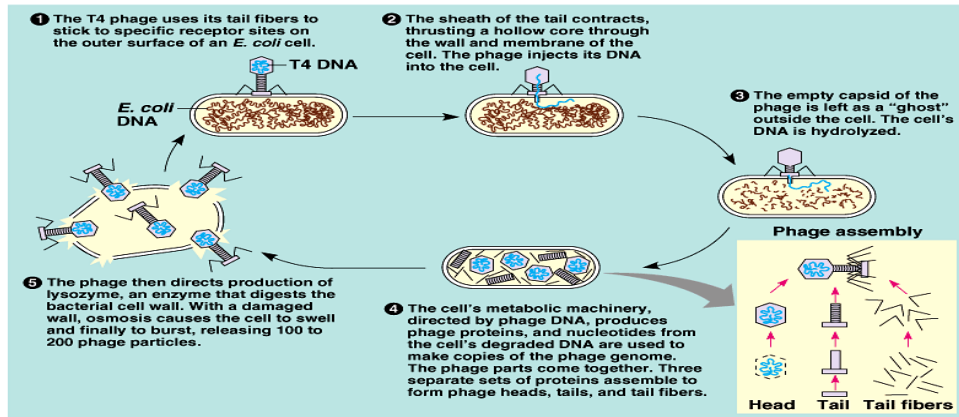
- Each type of virus can only infect a limited range of host cells called the _____. Viruses are able to identify their hosts by _____ receptors on the surface of the host cells that form a _____ fit with receptors on the surface of the virus. Some viruses’ host range is so small it includes only _____ species. While other viruses like _____ can infect raccoons, skunks, dogs and humans. In addition, most viruses that infect eukaryotes are _____ specific. For instance, cold viruses infect **only** the cells of the _____ tract and HIV infects **only** _____.

- Once the virus is inside the host cell it takes _____ of the host. It reprograms the cell to make copies of the viral _____ and viral _____. The host cell provides the _____, enzymes, ribosomes, RNA, amino acids, ATP, etc. for the making of viral parts.



C. Viral Cycles:

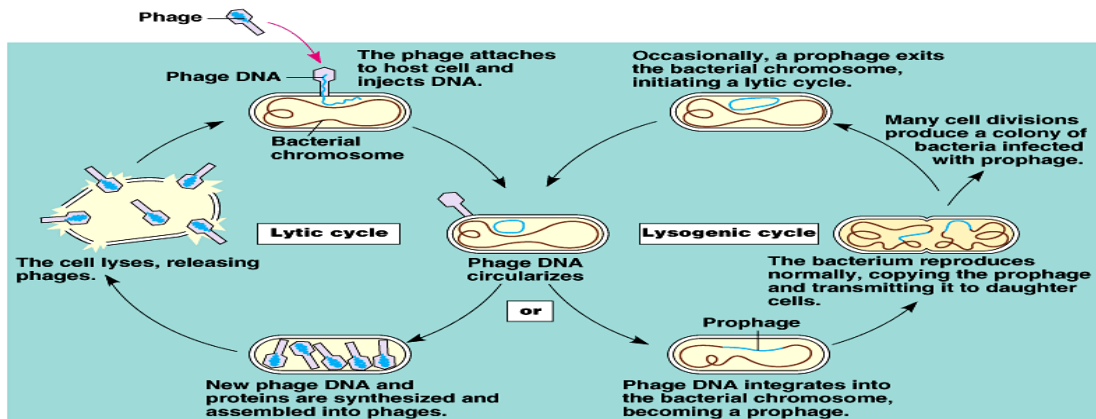
•The _____ cycle is a viral cycle in which during the last stage of infection _____ of viruses burst free from the host cell causing the host cell to _____ or break open. The lytic cycle first destroys the host's _____ and eventually _____ the host, then the viruses are free to go infect other healthy cells. A virus that reproduces by this lytic cycle is called a _____ virus (virulent = very infectious). Virulent because of host destruction and the process is very fast, _____ minutes.



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•Luckily for host cells, many have evolved to protect themselves from viral infections. For example, some bacterial hosts have _____ their surface receptors and are no longer recognized by a particular bacteriophage. Also, some host cells have _____ that are able to break down viral DNA or RNA. However, just as hosts evolve to protect themselves from viruses, viruses also evolve to counteract this.

•The _____ cycle is when a virus infects a host cell but doesn't _____ the host. Also, with the lysogenic cycle, the viral DNA does _____ destroy the host's DNA. Instead, the viral DNA becomes _____ into the host's DNA. Once the viral DNA is a part of the host's DNA it is called a _____. It does not interfere with the normal functioning of the host cell. But every time the host cell reproduces, the viral DNA gets copied as well. This can go on for _____ until the lysogenic cycle is triggered to switch to the _____ cycle and the viruses are free to infect more cells. The "trigger" varies but is often physical or emotional _____.

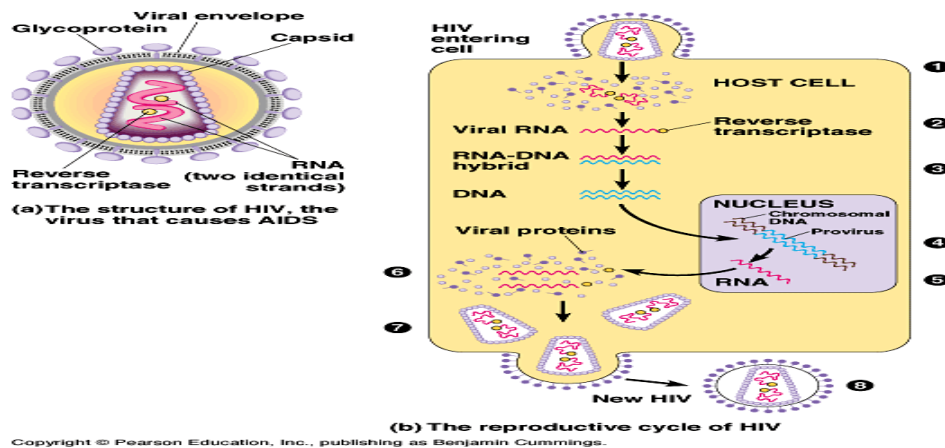


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•In addition, some prophage genes in the lysogenic cycle can alter the _____ of the host cell. For example, the bacteria that causes scarlet fever would be harmless to humans if it were not for the prophage genes in the bacteria that cause the host bacteria to make _____.

D. RNA Viruses:

•Most viruses have _____ as their genetic material. While there are different types of RNA viruses that work differently within the host cell, we will focus on the one that causes AIDS - the _____. Retro means _____ because these viruses have _____ and use an enzyme within the virus itself called _____ to make _____. The DNA is then integrated into the host's DNA as a _____ cycle where it will be replicated over and over again in a _____ cycle. This is why HIV infected individuals can appear unaffected for so long (sometimes up to 10 years). In addition, instead of lysing the cell early on, the HIV viruses can _____ off from the host cell and go infect other _____. This cycle can then at any time switch to the lytic cycle and destroy _____ cells enough that there is almost a total loss of immunity and one no longer just has HIV, but _____. Recall that HIV is a difficult antigen for the body to destroy because it keeps _____ and the immune system cannot keep up with it. The reason for all the mutations of RNA viruses is because they do not have the _____ steps of DNA replication. One common drug to control HIV is _____. This drug interferes with the action of _____.



E. Vaccines and Emerging Viruses:

•Recall that vaccines are _____ or _____ forms of pathogens (viruses or bacteria). Because they are dead or weakened they _____ cause disease, but instead stimulate the immune system to mount a defense in the event of a “live” attack. The first vaccine was made by a physician named _____. He noticed that milkmaids who contracted _____ (a mild disease that usually infects cows) were resistant to _____ (a disease that often resulted in death). He then scratched a _____ with a needle containing fluid from the sore of a milkmaid who had cowpox. When the boy was later exposed to smallpox, he _____ get sick. The cowpox and smallpox viruses are so _____ that the immune system cannot distinguish them.

•While vaccines can be used before one gets a _____ or _____ infection, antibiotics **cannot** be used on _____ infections. Vaccines are usually

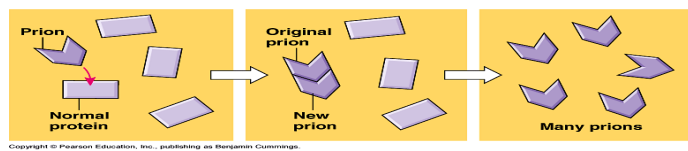
given _____ one gets an infection, while antibiotics are used _____ one gets a bacterial infection. Antibiotics can _____ be used on _____ infections because antibiotics kill bacteria by inhibiting _____. Recall that most viruses lack _____. However, some viruses like HIV do have enzymes and that is why AZT is being used to stop the action of reverse transcriptase. In addition, antibiotics like _____ interfere with the enzymes that build _____. And viruses _____ have cell walls, while bacteria do.

•Viruses seem to always be _____ because of several reasons. One reason that was already mentioned was that RNA viruses _____ often. This is why there is a _____ shot almost every year for the RNA influenza virus. In addition, new viral diseases arise as viruses _____ their _____. This was the case with the _____ which was spread from _____ in SW United States to humans who inhaled the dust containing traces of urine and feces from the mice. Also, increased _____, blood transfusion technology, sexual promiscuity, and _____ drug use have _____ viral disease cases. And as new roads are cleared and man explores once _____ plants, animals and tribes, viruses are spread. With plant viruses, they can also be spread by _____ that act as carriers and by farmers who inadvertently transmit the viruses on their gardening _____. Agricultural scientists are now breeding viral _____ crops that resist many viruses.

F. Viroids and Prions:

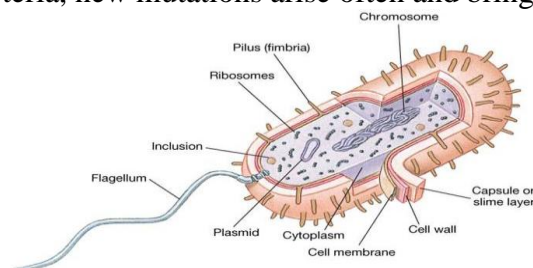
• _____ are smaller than viruses and are circular pieces of _____ that only infect _____. These RNA molecules can only replicate inside a host plant. When they do they disrupt plant cell metabolism and stunt plant _____.

• _____ are not nucleic acids like viroids, but are _____. Prions recently hit the news when they plagued the British beef industry causing _____ disease. A prion is a _____ protein normally present in _____ cells. When the prion gets into a cell containing the normal form of the protein, the prion converts the normal protein to a prion version causing _____ brain diseases.



G. Bacteria Structure:

•Bacteria are _____. They are _____ and divide by _____ approximately every _____ minutes. Most are genetically _____ to the parent cell. However, due to the _____ generation times creating _____ numbers of bacteria, new mutations arise often and bring about genetic variety.



H. Genetic Recombinants in Bacteria:

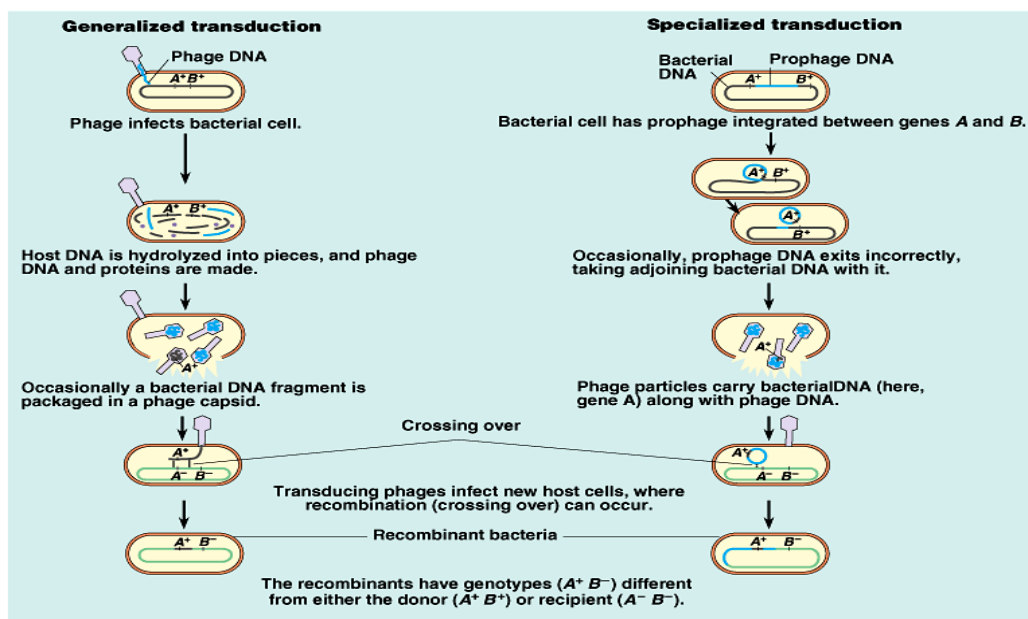
•While mutations do bring about diversity, so does _____ - combining DNA from 2 individuals into the genome of a single individual. There are 3 ways that this occurs: _____, _____, and _____.

Transformation:

•Recall the experiments of _____ where heat killed _____ cells transformed harmless _____ cells into pathogenic pneumonia that killed the host mouse. Transformation is the alteration of a bacterial cell's _____ by the uptake of foreign DNA from the environment. With Griffith's experiment, the live _____ cells took up a piece of DNA from the heat-killed _____ cells which enabled the R cells to get a _____. Having this smooth "coat" disabled the mouse's immune system to destroy the pathogenic bacteria and the mouse died. This transformation occurred because **some** bacteria are able to _____ closely related DNA in the environment and _____ it into their genome. While not all bacteria can pick up foreign DNA, they can be stimulated to pick up DNA with the help of _____. This technique is used to stimulate bacteria to incorporate _____ DNA that code for _____ such as insulin for diabetics.

Transduction:

•Transduction is when _____ carry bacterial genes from one host to another. There are 2 types: _____ transduction which involves the _____ cycle and _____ transduction which involves the _____ cycle.

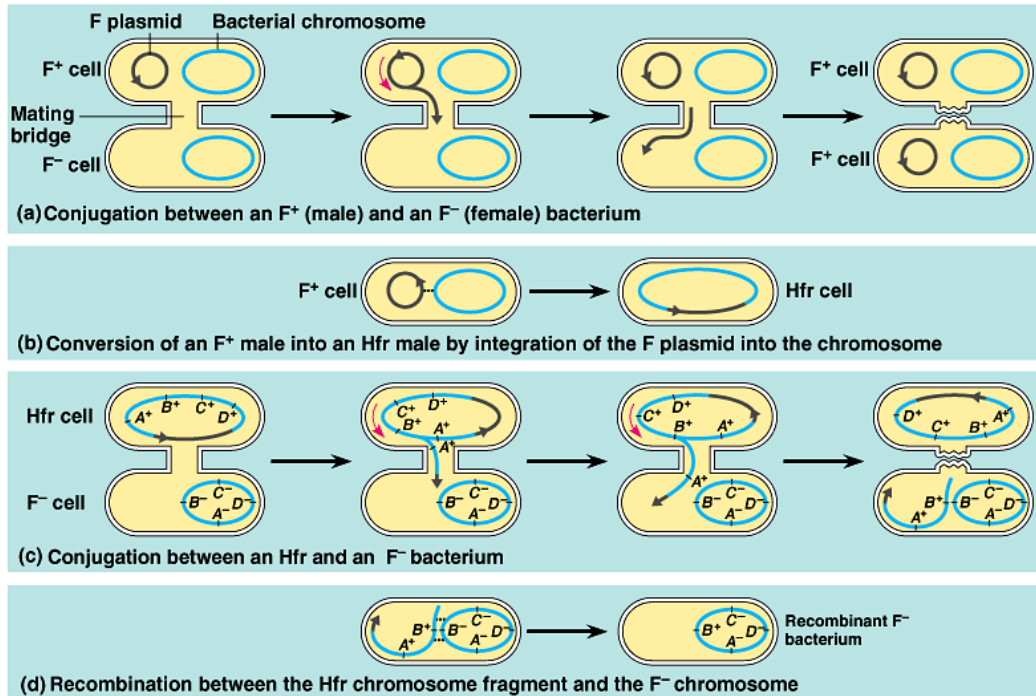


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Conjugation:

•Conjugation is the bacterial version of _____ in which one bacterial cell transfers _____ to another bacterial cell. The source of this DNA is usually from a _____. It is a _____ process in which the "male" makes a temporary cytoplasmic bridge called a _____ and transfers some DNA to a female. "Maleness" comes about due to the presence of a special piece of DNA called _____

the _____ (F= _____). Having the F factor enables the bacteria to be the _____ of DNA.



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- _____ are small pieces of self-replicating DNA in bacteria that are _____ from the nucleoid. While the F factor can be part of the nucleoid, it can also be part of the plasmid. If the F factor is in the plasmid, it is called the _____. It consists of _____ genes, most of which are required to make sex pili. Geneticists use the symbol _____ to denote a cell that contains the F plasmid and it is a “male”. Cells lacking the F plasmid are _____ and “female”. However, a _____ can become a _____ when 2 cells conjugate.

- But what if a bacterium didn’t transfer just a plasmid by conjugation, but also transferred part of the _____? This occurs when a _____ cell incorporates the _____ into **its own** _____. This creates what is called a _____ cell. Now with conjugation, this “male” Hfr cell will first undergo _____, then transfer part of the _____ (containing both a part of the original F plasmid **and** some genes from the bacterial chromosome/ nucleoid) to the _____ cell. Then _____ will occur between _____ regions of the newly transferred genes and the bacterial chromosome of the “female” cell.

I. R Plasmids:

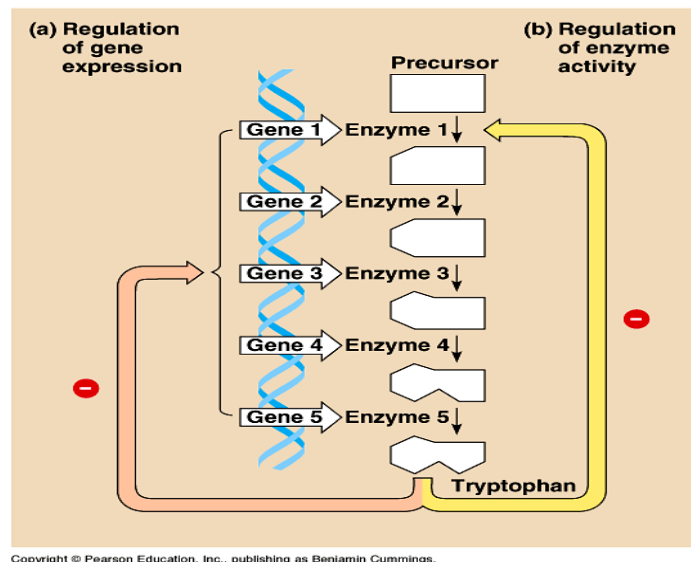
- Some plasmids carry genes that make them resistant to _____. These plasmids are called _____. When bacteria containing specific R plasmids are exposed to a specific antibiotic, they _____. R-plasmids code for enzymes that are able to break down antibiotics such as _____ or _____. This means these antibiotics _____ destroy the bacteria. Then by _____, an _____-ing number of bacteria become resistant to antibiotics. This makes treating _____ infections more difficult.

J. Transposons:

- A _____ is a transposable piece of _____ that can move from one location to another. In bacterial cells, transposons can move _____ the nucleoid, between the _____ and _____ or from one _____ to another _____.
- Transposons are sometimes called “_____ genes”. This is misleading because while _____ transposons do “jump” from one location to another, others just make a _____ and the copy gets inserted elsewhere.
- _____ was the first person to identify transposons in breeding experiments with Indian _____ in the 1940’s. She noticed changes in the color of corn kernels that could only be explained by “mobile” genetic elements capable of moving from one location to another in the genome.

K. Operons:

- _____ (the making or breaking of molecules) need to be controlled. For example, if an *E. coli* bacterium is deprived of one of the amino acids _____ from its environment in the colon, it needs to make its own to survive. Cells can _____ the numbers of specific enzymes made. If tryptophan accumulates in a cell, the cell shuts down the making of this amino acid by _____. This is _____ feedback inhibition because it is maintaining _____.



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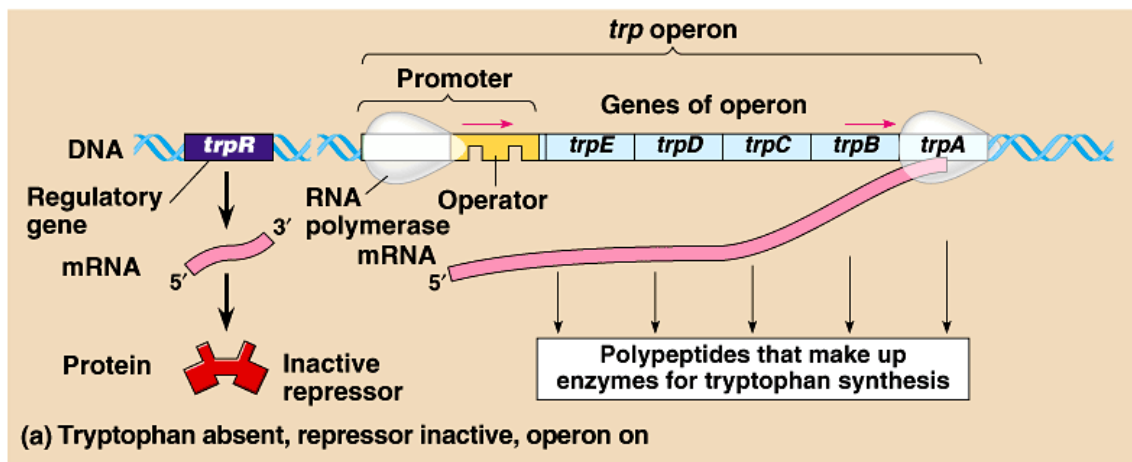
- The blocking of this metabolic pathway actually takes place at the level of stopping _____ of mRNA coding for these enzyme in the pathway. The _____ genes on the DNA molecule that code for the transcription of mRNA and later translated into tryptophan are _____ together on a chromosome. This segment of DNA is transcribed by one _____ site where _____ can bind to and begin transcription.
- However, the making of these enzymes can be “switched on” or “switched off” by a segment of DNA after the promoter called the _____. The operator controls _____.

the access of _____ to the genes. The promoter + the operator + the genes they control = _____.

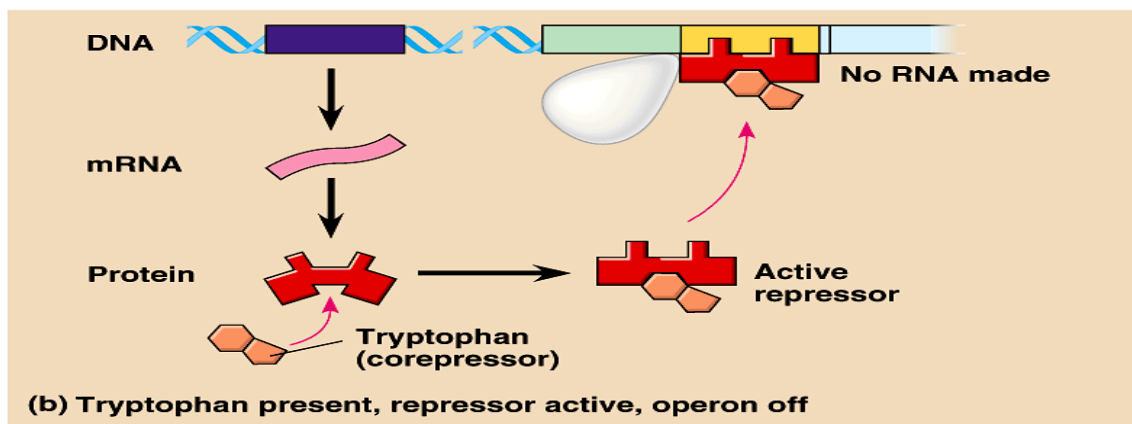
Operons:

•There are ___ types of operons we are going to learn about: _____ and _____. Repressible operons are _____ when a small molecule binds to its regulatory protein, where inducible operons are _____ when a small molecule binds to its regulatory protein.

•The tryptophan (trp) operon is a _____ operon because it is _____ by an _____ binding molecule. When no molecule is bound to the _____, the trp operon is _____. Located just upstream of the operon is a _____ gene that makes a _____. If a lot of tryptophan is present in the cell this _____ the repressor which then binds to the _____ and the operon is _____.

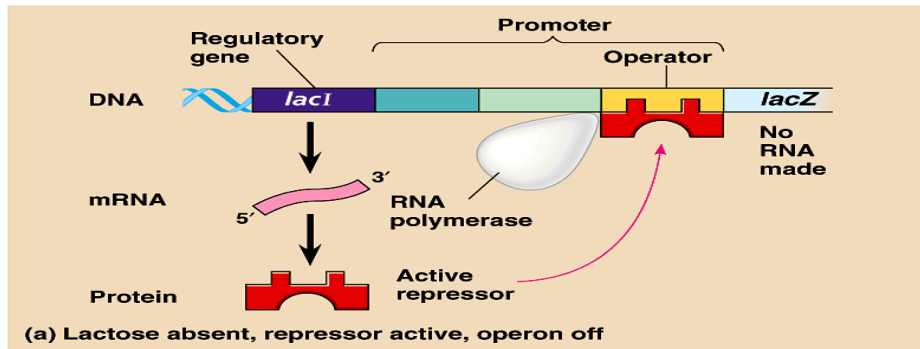


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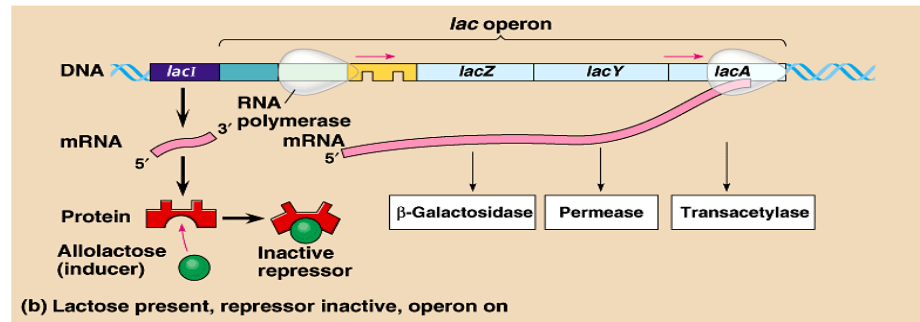


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•The _____ operon is an _____ operon because it is _____ when a small molecule binds allosterically to its _____ protein, removing it from the _____. The lac operon makes the enzymes that hydrolyze _____. When a bacterium is exposed to milk, this signals the bacterium it needs to make enzymes to break it down.



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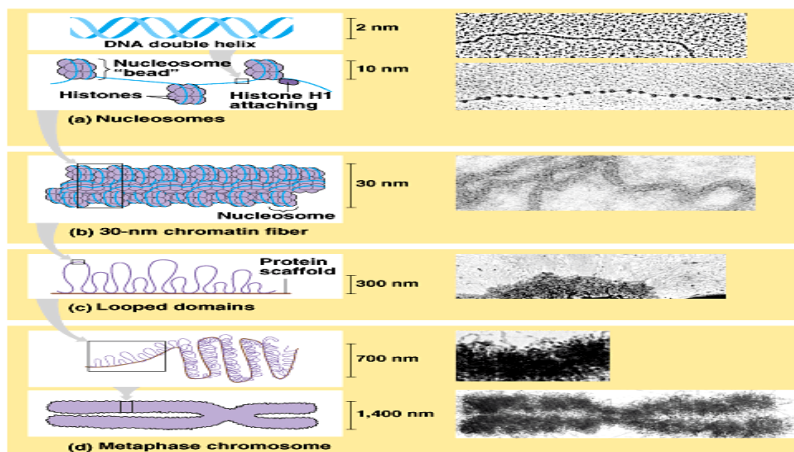
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•Repressible operons usually function in _____ pathways (the making of something). Where inducible operons usually function in _____ pathways (the breaking down of something).

L. DNA Packaging:

•Recall that DNA exists in its loose “stretched out” form called _____ during _____ of the cell cycle. Then during _____ of mitosis and meiosis I, the chromatin condenses into X-shaped structures or replicated _____.

Eukaryotic DNA is also combined with a large amount of _____ called _____. There are 5 types of _____ charged histones that the _____ charged DNA molecule wraps itself around. DNA is negative due to the _____ groups. The combination of DNA wound around histones are called _____ and has the appearance of _____.



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